

# NASA SPACE APP CHALLENGE - 2025

Team Name: Kosomics  
Project Name: AiroWatch



The image displays three prototypes of the AiroWatch platform. In the center is a large tablet showing the 'Air Quality Intelligence Map' with a map of North America and various data layers like aerosol optical depth and NASA Worldview. To the left is a smartphone showing the 'Analytics' section with line graphs for 'Past 24 Hours' and 'Next 24 Hours' air quality predictions. To the right is another smartphone showing a detailed 'AIR QUALITY INTELLIGENCE' dashboard with a large red circle indicating a value of 165 and sections for 'Pollutant Analytics' and 'Heatwave Monitoring'.

<https://airowatch.vercel.app/>

Powered By 

## What is AeroWatch?

A platform for environmental monitoring driven by AI, AiroWatch was created for the NASA Space Apps Challenge 2025. To safeguard people throughout the world, it monitors heatwaves, wildfires, and air quality by fusing real-time AI insights with NASA satellite data. With its worldwide alerting system, AI assistant, and NGO emergency dashboard, AiroWatch connects Earth observation with practical human impact.

## **Our Team:**

We are Team Kosomics, A passionate group of innovators with four different brilliant mind members from Bangladesh coming from one of the most polluted and climate vulnerable countries in the world who are dreaming of to fight against the air pollution by weaponizing NASA'S Data against the pollution to ensure people clean and safe breath not only the country like us but also the world.

Our Team Consists of:

Aanika Bintey Shahid	Team Lead Coordination & Content
Muntahi Safwan Mahfi	Web, AI Implementation & System Design
Mazedul Rion Islam	Edge Servers, Data Processing & System Design
Rahin Ibne Harun	Research & Content

## **Our Mission:**

We're working relentlessly, determined to bring transformative change by combining our innovative ideas with NASA's satellite data and the power of artificial intelligence — creating solutions that directly save lives and improve public health globally.

## **Challenge:**

From EarthData to Action: Cloud Computing with Earth Observation Data for Predicting Cleaner, Safer Skies

## **Why did we choose this Challenge?**

A Personal and Global Crisis

Dhaka ranks among the most polluted cities on Earth, with:

- AQI levels reaching hazardous extremes (>400)
- PM<sub>2.5</sub> levels 18x higher than WHO standards
- Every breath is a health risk

This is too personal for us — we face it in our everyday life. Air pollution is not just an environmental concern; it is a public health crisis that demands immediate action.

## Why Does This Matter Globally ?

By tackling Dhaka's air pollution, we create a scalable solution for megacities worldwide. This problem is both:

- Immediately urgent for millions in Bangladesh
- Globally relevant for polluted cities across Asia, Africa, and beyond
- Life-threatening – affecting over 23 million people in Dhaka alone

Unlike other environmental challenges, air pollution is a daily, invisible killer that affects every breath we take. We chose this challenge because solving it here means creating a blueprint for the world.

## Project Summary:

**Project Name:** AiroWatch

**Project Tagline:** "Weaponizing NASA's Data Against Pollution – One Breath at a Time"

### **Short Summary:**

AiroWatch is an environmental monitoring and disaster response platform developed for the NASA Space Apps Challenge 2025. This comprehensive solution combines NASA's satellite network, advanced AI, and cloud computing to deliver real-time air quality monitoring, wildfire tracking, heatwave detection, and emergency response coordination on a global scale which uses Edge Servers for proper distribution across different channels like Television, Radio, Mobile SMS etc.

### **Video Demo**

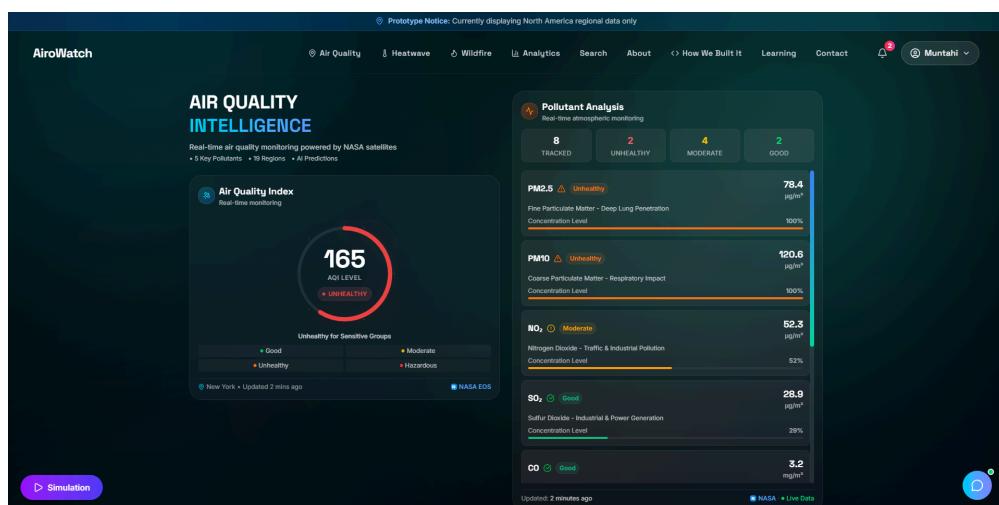
YouTube Link: [https://youtu.be/ydBHcv\\_tUYo](https://youtu.be/ydBHcv_tUYo)

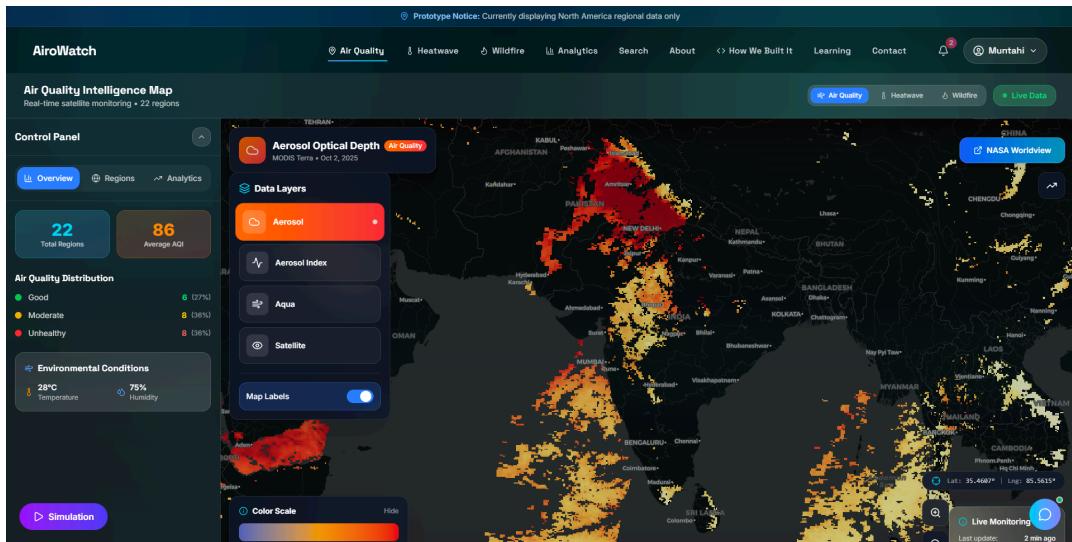
### **Live Demo**

Frontend: <https://airowatch.vercel.app>

Backend API: <https://nsac-mu.vercel.app>

### **Screenshots:**





**AiroWatch**

Prototype Notice: Currently displaying North America regional data only

**Safety Article** (High Priority)

## Wildfire Smoke Protection: Essential Precautions

Learn how to protect yourself and your family during wildfire smoke events with these critical safety measures.

Emergency Response Team | Environmental Scientist | Jan 20, 2024 | 10 min read | 4313

**Simulation**

**Hazard Simulation**  
Air Quality Emergency Scenario

**Simulation Parameters**

**Person Profile**

- Age: 80 years old
- Health Conditions:
  - Asthma
  - Chronic Obstructive Pulmonary Disease (COPD)
- Location: Mirpur, Dhaka

**Air Quality Data**

- AQI: 250 (Hazardous)
- PM2.5: 180 µg/m³
- Pollutants: PM2.5, PM10, NO2, O3

**AI Health Risk Assessment**

For an 80-year-old individual with Asthma and COPD, the current hazardous air quality (AQI 250, PM2.5 180 µg/m³) poses severe health risks including respiratory distress, increased risk of heart attack, and potential hospitalization. Immediate action is critical: stay indoors, use air purifiers, take prescribed medications, and seek medical attention if breathing difficulties worsen.

Note: This simulation will activate hazard alerts, change the banner to red, and display sequential safety notifications. You can stop the simulation at any time.

**Cancel**   **Start Simulation**

Hazard Alert: Air Quality Emergency - AQI 250 (Hazardous)

AiroWatch

Community Protection

## Protecting Communities Together

Join our network of NGOs and non-profit organizations dedicated to protecting communities from environmental hazards. Get the tools you need to save lives during disasters and air quality emergencies.

- Instant regional alerts to thousands of users
- Real-time safety status tracking
- Location-based emergency notifications
- Dashboard for community management

Register Your NGO > Already registered? Sign in

Reset

CRITICAL ALERT: Air Quality Index has reached hazardous levels (AQI 250). Immediate action required for all residents, especially vulnerable populations.

HEALTH WARNING: PM2.5 levels at 180 µg/m³. Individuals with asthma, COPD, or cardiovascular conditions must stay indoors immediately.

DANGER: Air Quality Alert  
HEALTH WARNING: PM2.5 levels at 180 µg/m³. Individuals with asthma, COPD, or cardiovascular conditions must stay indoors immediately.  
airwatchvercelapp.com

CLOSE

DANGER: Air Quality Alert  
HEALTH WARNING: PM2.5 levels at 180 µg/m³. Individuals with asthma, COPD, or cardiovascular conditions must stay indoors immediately.  
airwatchvercelapp.com

CLOSE

Hazard Alert: Air Quality Emergency - AQI 250 (Hazardous)

AiroWatch

Air Quality Heatwave Wildfire Analytics Search About How We Built It Learning Contact Muntahi

AI Tip of the Day

Fri Oct 03 2025

Elevate your indoor air quality today by identifying and reducing sources of chemical pollutants like strong air fresheners or scented candles. Opting for natural ventilation or unscented alternatives significantly improves the air you breathe, creating a healthier and more invigorating home environment.

Reset

SO<sub>2</sub> Good Sulfur Dioxide - Industrial & Power Generation Concentration Level 28.9 µg/m³ 29%

CO Good Carbon Monoxide 3.2

Updated: 2 minutes ago

AI Location Insights

New York, United States

Hey there! Right now, the air quality in New York is considered "Unhealthy," which means there's a noticeable amount of fine dust and tiny particles around that can be bothersome for most people. You might even notice a bit of haze, almost like the air in a very busy street has spread everywhere. For a good idea to maybe enjoy indoor activities or outdoor time a bit shorter, especially if you're sensitive to air quality. Taking a little extra care today can help you stay comfortable and healthy!

PM2.5: 78.4 µg/m³ NOx: 52.3 ppb O<sub>3</sub>: 95.8 ppb

AI Environmental Expert

Powered by NASA DBS Data

Quick Tips Trends Activities

Hello! I'm your Environmental Health AI assistant, powered by NASA satellite data. I can help you understand air quality, health risks, and provide personalized recommendations. How can I assist you today?

06:11 PM

Current AQI: 165

Ask about air quality, health tips...

PM2.5: 78.4 µg/m³ NOx: 52.3 ppb O<sub>3</sub>: 95.8 ppb

Sign in' and a link to 'Back to main site'."/>

Register Your NGO  
Join us in protecting communities from environmental hazards

NGO Name \*

Your organization name

Email Address \*

ng@example.com

Contact Phone

+880...

Operating Region \*

e.g., Chittagong

Country \*

Bangladesh

Organization Description

Brief description of your organization's mission...

Password \*

Min. 6 characters

Confirm Password \*

Re-enter password

Register NGO

Already have an account? [Sign in](#)

← Back to main site

## WHY We Built This

### The Problem

- 23 million people in Dhaka breathe hazardous air daily
- Air pollution causes 15% of deaths in Bangladesh (WHO)
- Children, elderly, and people with respiratory diseases are most vulnerable
- No accessible, real-time air quality system for citizens and NGOs
- Lack of early warning systems for pollution spikes and health risks

### The Impact

- 167,000+ deaths annually in Bangladesh due to air pollution
- Increased hospital admissions during pollution spikes
- Stunted child development from toxic air exposure
- \$6.5 billion economic loss annually (World Bank)

## WHAT We Built

AiroWatch is a comprehensive air quality intelligence platform that combines:

## 1. Real-Time Monitoring System

- Satellite-based air quality tracking using NASA MODIS, VIIRS, Sentinel-5P
- Pollutant detection: PM2.5, PM10, NO<sub>2</sub>, SO<sub>2</sub>, CO, O<sub>3</sub>
- Air Quality Index (AQI) calculation with health recommendations
- 3-hour update frequency using NASA's GEOS-CF forecasts

## 2. Wildfire Detection & Smoke Tracking

- Active fire detection using NASA FIRMS (Fire Information for Resource Management System)
- Smoke plume prediction using atmospheric dispersion models
- Fire intensity analysis with Fire Radiative Power (FRP) metrics
- Real-time alerts for communities at risk

## 3. Heatwave Prediction System

- 7-day heatwave forecasts using land surface temperature data
- Heat index calculations combining temperature and humidity
- Vulnerable population alerts for elderly and children
- Cooling center recommendations during extreme heat events

## 4. Personalized Health Alerts

- User health profiles: Age, diseases (asthma, COPD, heart disease), allergies
- Smart notifications: SMS, email, and in-app alerts
- Actionable recommendations: "Stay indoors," "Wear N95 mask," "Avoid outdoor exercise"
- NGO coordination: Direct communication with relief organizations

## 5. Interactive Map Interface

- Color-coded AQI heatmap showing pollution hotspots
- Wildfire markers with real-time fire data
- Heatwave zones with severity indicators
- Historical data visualization showing pollution trends

## 6. Analytics Dashboard

- Pollution trends over time (daily, weekly, monthly)
- Comparative analysis across different regions
- Health risk assessments based on user profiles
- Policy insights for government decision-making

## 7. Educational Resources

- Learning modules about air pollution, health effects, and protection measures
- Interactive quizzes to test knowledge

- Gamification: Earn points, badges, and achievements
- Community engagement through shared stories and tips

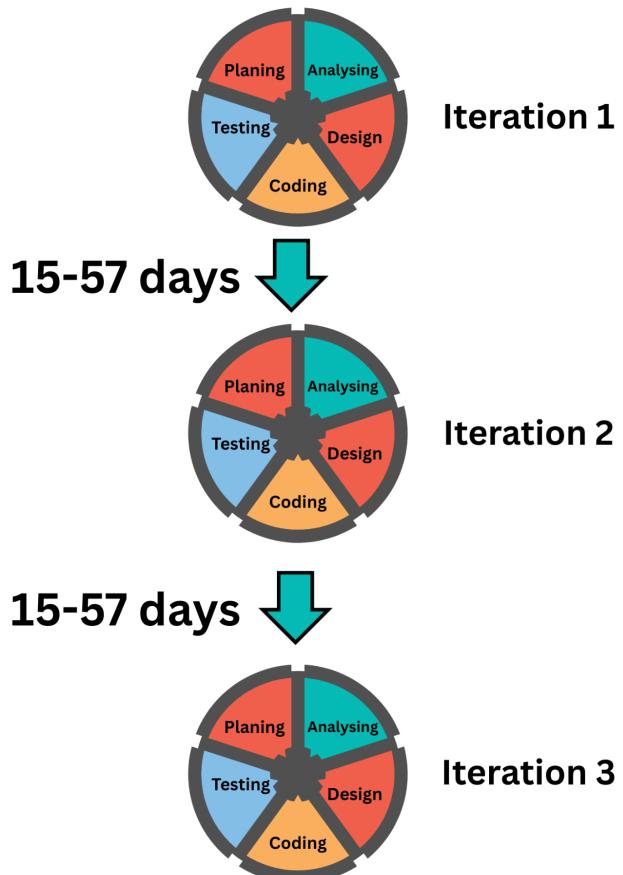
## 8. Multiple Edge Server

- Multiple Streams of Distribution Channel are open due to the creation of edge servers to distribute and pass alert and data across TV stations, Radio Stations and Telco Tower.
- Improves far rural data distribution
- Empowers local communities

## How does our system work ?



## How We Worked?



**Fig:Graphical Agile Model**

## Tech Stack

### **Frontend Technologies**

- React 19.1.1 - Modern UI framework with React Compiler for optimal performance
- TypeScript 5.8.3 - Type-safe development with strict typing
- Tailwind CSS 4.1.13 - Utility-first CSS framework for responsive design
- Vite 7.1.7 - Lightning-fast build tool and development server
- React Router 7.9.3 - Client-side routing with protected routes
- Leaflet - Interactive map library for geospatial visualizations
- Recharts 3.2.1 - Composable charting library for data visualization
- Axios 1.12.2 - Promise-based HTTP client for API calls
- Lucide React - Beautiful, consistent icon library
- Radix UI - Accessible, unstyled component primitives

- React Markdown - Markdown rendering with GitHub-flavored markdown support

## Backend Technologies

- Node.js 20+ - JavaScript runtime environment
- Express.js 5.1.0 - Fast, minimalist web framework
- Prisma 6.16.2 - Next-generation ORM for type-safe database access
- PostgreSQL - Robust relational database with PostGIS for geospatial data
- JWT (jsonwebtoken 9.0.2) - Secure authentication tokens
- bcryptjs 3.0.2 - Password hashing and salting
- GROQ AI API - Advanced AI integration for chatbot and insights
- Express Validator 7.2.1 - Middleware for input validation

## Data Processing Pipeline

- Python 3.8+ - Data processing and analysis
- NetCDF4 - Reading NASA satellite data files
- NumPy - Numerical computing for large datasets
- Pandas - Data manipulation and analysis
- Prisma Python - Type-safe database ORM
- Requests - HTTP library for API calls to NASA services
- Cron Scheduler - Automated hourly data collection

## Future Scopes:

With more data and resources, we can increase our accuracy and expand worldwide. We can support the government, NGOs, TV and Radio stations with our eco system making it a standard way of hazard management globally.

We have plans to expand and work with natural disaster and disaster response to make the eco system more effective worldwide. We are already covering alternative channels like telco, terrestrial Radio & TV and satellite Radio & TV. But we are also working on integrating Satellite to direct Phone SOS messages which will make our delivery challenges more stronger.

This system is designed to get better with time by ingesting more & more data and more edge servers.

The next generation deserves a better world.

## Resources Link:

- <https://api.nasa.gov/>
- <https://www.earthdata.nasa.gov/>

- <https://firms.modaps.eosdis.nasa.gov/>
- <https://tempo.si.edu/>
- [https://gmao.gsfc.nasa.gov/GEOS\\_systems/geos-cf.php](https://gmao.gsfc.nasa.gov/GEOS_systems/geos-cf.php)
- <https://www.who.int/>